Chapter 1

Executive Summary

In December 1999, the King County Council approved the development of a Regional Infiltration and Inflow (I/I) Control Program as part of the Regional Wastewater Services Plan (RWSP). The presence of I/I in the separated sewer system takes up needed capacity for conveying and treating wastewater generated by homes and businesses. The purpose of the I/I program is to reduce the amount of flow, thereby reducing the risk of sanitary sewer overflows and the costs of conveying and treating wastewater.

In 2000, the County's Wastewater Treatment Division, in cooperation with the local component agencies that it serves, launched an ambitious six-year $41-million I/I control study. The study includes efforts to identify sources of I/I, test the effectiveness of various I/I control technologies, examine the benefits and costs of I/I control, and prepare a regional plan for reducing I/I in local agency collection systems.

Development of a set of alternative approaches to controlling regional I/I marks a major milestone in the study. The following text summarizes these alternatives and the complex issues that affect I/I control in the region.

1.1 I/I Control Study

A comprehensive six-year I/I control study (summarized in Figure 1-1) began in 2000 and is scheduled to be completed at the end of 2005. The study consists of five steps; each step responds to a specific RWSP I/I control policy. The steps are as follows:

- Define current levels of I/I for each local agency tributary to the regional system.
- Select and construct pilot projects to demonstrate the cost-effectiveness of collection system rehabilitation projects.
- Develop model standards, procedures, and policies for use by local agencies to reduce I/I in their systems.
- Identify cost-effective options to remove up to 30 percent of I/I expected to occur in local agency systems during a 20-year peak flow condition.
- Develop a long-term regional I/I control program for review and approval by the County Council.

A few useful definitions…

Infiltration. Groundwater that seeps into sewers through holes, breaks, joint failures, defective connections, and other openings.

Inflow. Stormwater that rapidly flows into sewers via roof and foundation drains, catch basins, downspouts, manhole covers, and other sources.

Long-term I/I control. Policy, administrative, financial, and technical measures aimed at limiting future increases in I/I flow.

Direct I/I reduction. Sewer rehabilitation or replacement projects done to reduce I/I flows and alleviate immediate downstream capacity constraints in a basin.

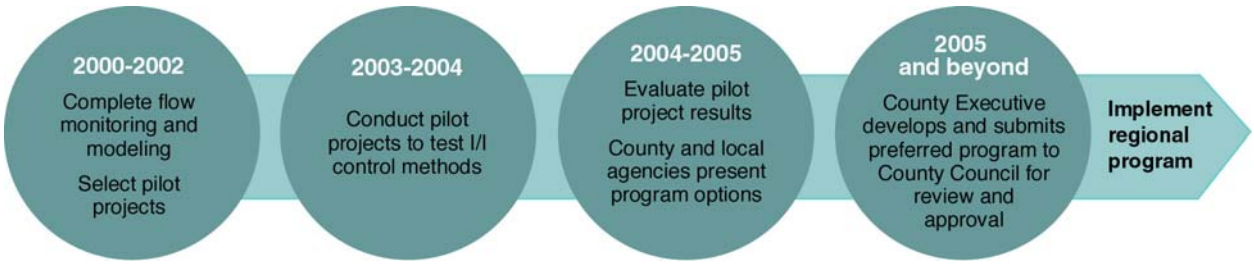

Figure 1-1. Regional Infiltration/Inflow Program Milestones

With the development of the I/I program alternatives described in this report, the first three components of the study are complete. The fourth component will be complete by April 2005 with the completion of a benefit-cost analysis and the *Regional Needs Assessment Report*. By December 31, 2005, the King County Executive will submit to the King County Council a plan for a long-term regional I/I control program. The program will identify target I/I levels for local systems. It also will identify long-term I/I control measures to meet these targets and to serve as cost-effective alternatives to planned conveyance and treatment projects. After Council approval of the program, implementation can begin.

The I/I study is unique in a number of ways. It is voluntary and primarily County-funded, even though most of the program focuses on local systems. Most important, planning and implementation are being done in partnership with the local agencies that contribute wastewater to the King County system.

1.2 Summary of Program Alternatives

The County considered a number of alternative approaches for an I/I control program and then narrowed the field to four (Table 1-1). The four alternatives described in Chapter 4 of this report provide a range of approaches from which to begin developing a recommended program. With the exception of Alternative 4, each alternative includes three core elements for I/I reduction:

(1) a distinct approach to defining the target level of I/I reduction,
(2) measures of cost-effectiveness for I/I reduction projects, and
(3) methods for funding I/I reduction projects.

The approach to defining the target I/I reduction level in each alternative serves as the driver for the other two elements. Several other program elements combine with these core elements to form complete program.

1.2.1 Alternative 1: Reduce Peak I/I by 30 Percent in the Regional Service Area from the Peak 20-Year Level

The 30-percent goal, established by policy in the RWSP, was based on information obtained from other jurisdictions around the country. It is not known if the goal is feasible in this region.

Under Alternative 1, cost-effective I/I reduction projects that meet a 1:1 benefit-to-cost ratio would be implemented as a priority. Projects with greater benefits than costs would accumulate savings that could be used for constructing additional I/I reduction projects. Once the cost-effective projects are implemented, additional I/I reduction projects (if needed) would be implemented until the 30-percent reduction goal is met. Projects would be funded through regional grants.

1.2.2 Alternative 2: Implement I/I Reduction Projects that Are Found to be Cost-Effective Based on a *Region-Wide* Evaluation

Alternative 2 responds to an RWSP policy that calls for rehabilitation of portions of the regional conveyance system to reduce I/I whenever the cost of rehabilitation is less than the cost of conveying and treating that flow.

Table 1-1. Summary of I/I Control Program Alternatives

	Target I/I Reduction Level	Cost-Effectiveness	Funding
Alt. 1	30 percent	Used to prioritize projects for implementation	County wastewater revenues
Alt. 2	Determined after cost-effective projects are implemented	Combined list of recommended I/I reduction projects must at least meet 1:1 benefit-to-cost ratio	County wastewater revenues, local agency funds, and/or direct payment by private property owners
Alt. 3	Determined after cost-effective projects are implemented	Each I/I reduction project must at least meet 1:1 benefit-to-cost ratio	Same as Alternative 2
Alt. 4	Based on an agreed-upon threshold	N/A	**I/I reduction:** Local agency funds and/or direct payment by private property owners **Monitoring and enforcement:** County wastewater revenues

Implementing this alternative should cost no more than constructing conveyance and treatment projects region-wide. All cost-effective I/I reduction projects with at least a 1:1 benefit-to-cost ratio would be implemented. I/I reduction projects would be funded through regional grants. Additionally, local agencies could contribute funds to bring an I/I reduction project up to the 1:1 benefit-to-cost ratio. This funding could be from the local agency or from a County low-interest loan. Projects with greater benefits than costs would accumulate savings that could be used for constructing additional I/I reduction projects. The percent of I/I reduction at peak flow across the entire regional wastewater system would be estimated based on the estimated cumulative reduction volumes of all proposed I/I reduction projects.

1.2.3 Alternative 3: Implement I/I Reduction Projects that Are Found to be Cost-Effective Based on a *Project-Specific* Evaluation

Alternative 3 also responds to the RWSP policy described in Alternative 2. It differs from and is less costly than Alternative 2 because each I/I reduction project would be evaluated for cost-effectiveness based on its own cost savings in comparison to the costs of conveying and treating wastewater flows with higher levels of I/I. Each I/I reduction project would need to at least meet the 1:1 benefit-to-cost ratio. Projects with greater benefits than costs would accumulate savings but would not fund other I/I reduction projects that are not cost-effective. The same methods as described in Alternative 2 would be used to estimate the I/I reduction level, and to fund I/I reduction projects.

1.2.4 Alternative 4: Set a Fixed Maximum I/I Threshold Expressed as Gallons per Acre per Day (gpad) at Peak Flow for Each Local Agency

Alternative 4 responds to an RWSP policy that calls for provision of incentives for local agencies to meet an established maximum allowable threshold of I/I during peak flow conditions. Under this alternative, the maximum threshold would be uniform for each agency that had initial I/I levels exceeding the threshold. Agencies with I/I levels lower than the maximum threshold would be required to maintain that I/I level with an agreed-upon allowance for pipe degradation over time. The maintenance of these lower-than-maximum levels would be required because the regional conveyance and treatment system is designed and constructed to convey existing and projected peak I/I flow quantities for those agencies, not the maximum amount allowed by a higher threshold.

Alternative 4 differs from the other three alternatives in that it relies more on regulating the local agencies and less on regional cooperation to reduce I/I levels. The I/I reduction percentage would be based on the percent of I/I reduction region-wide, assuming that each agency contributes either I/I equal to the established maximum threshold or an actual flow amount for those agencies with I/I levels under the threshold. Local agencies would be responsible for implementing I/I reduction projects, including funding the projects or making arrangements with private property owners. Extensive monitoring would be necessary to evaluate whether local agencies are meeting the established threshold. Incentives and/or penalties (such as a surcharge) could be required to attempt to achieve and maintain thresholds over time.

1.3 Issues Related to Program Development

In 2004, the E&P Subcommittee[1] continued to work toward reaching consensus on a number of complex issues related to the alternatives presented in this report. The subcommittee's consensus decisions guided the County in developing the alternatives and, along with input from program workshops, allowed local agencies to shape the parameters of a regional I/I control program. These and other issues will come into play during evaluation of the alternatives and preparation of the long-term regional I/I control plan. Issues include setting mandatory or voluntary provisions for local agency compliance, funding I/I projects, establishing target levels for I/I reduction, and defining roles and responsibilities.

1.3.1 Setting Voluntary or Mandatory I/I Provisions for Local Agency Compliance

The adopted RWSP requires that the establishment of a mandatory I/I threshold be considered for local agencies. Such a threshold would set a maximum allowable level of I/I that could enter the regional treatment and conveyance system during periods of peak flow. Currently, some contracts between the County and local agencies stipulate that flows above 1,100 gpad are subject to an additional charge, but because this contract provision has not been uniformly applied, it has not been enforced. Further, sewer pipes constructed prior to 1961 are exempt from this provision.[2]

An I/I threshold could serve as a useful tool for maintaining relatively low I/I levels in the regional system over time. However, setting a threshold value and putting it into practice would be complicated. Some agencies could be required to make significant repairs and upgrades to their systems to meet the threshold, while others may be operating below an established threshold. In addition, detailed monitoring to measure flows in relation to an established threshold could be costly.

Also under evaluation is whether to charge local agencies for not complying with adopted target levels for I/I reduction. Measures being considered are surcharges, incentives, and variable rates. Fundamental questions remain regarding whether these measures would have any positive impact on I/I levels in the regional system. Agencies may find it less expensive to pay a surcharge or higher rates in lieu of paying for I/I improvements. In addition, the revenue generated from surcharges or higher rates may not be enough to pay for I/I rehabilitation projects. As is the case with the I/I threshold issue, all of these measures would carry significant administrative and monitoring costs.

[1] The Engineering and Planning (E&P) Subcommittee is a subcommittee to the Metropolitan Water Pollution Abatement Advisory Committee (MWPAAC), a committee composed of representatives from the 34 local component agencies that contribute wastewater to the King County system..

[2] Sewer pipes built by the local agencies before 1961 represent the oldest parts of the system and are also often a source for high levels of I/I. An analysis will be conducted to determine whether flows in these pipes should be included in determining whether an agency is meeting the threshold.

Finally, the County and local agencies continue to discuss whether the standards, procedures, guidelines, and policies, when finalized, should be implemented as requirements region-wide or as a mix of standards and guidelines.[3] There is general agreement that standards, procedures, guidelines, and policies could be applied uniformly as requirements for I/I repair and rehabilitation projects paid for by County wastewater revenues. However, local agencies generally believe that some standards should be implemented as guidelines for I/I projects and other work that the agencies fund in their respective service areas.

1.3.2 Establishing Target Levels for I/I Control Program

RWSP policies set the overall target for peak I/I reduction in the service area as 30 percent below the 20-year peak level. Other options for setting target levels of I/I reduction were considered during development of alternatives. These options include setting I/I thresholds for local agencies, as discussed above, and using the cost-effectiveness of I/I reduction projects, either on a regional or project-specific basis, to determine the level of I/I reduction to undertake.

1.3.3 Funding I/I Reduction Projects

Four options are being considered for funding cost-effective I/I reduction projects: (1) the County pays all costs, (2) the County and local agencies share the costs, (3) private property owners fund all or part of the costs (for I/I repairs on private property), and (4) another project pays for part of the costs. The local agency contribution of funds could make an I/I project cost-effective for the County, while at the same time providing the agency with a system upgrade partially funded by the County. An I/I reduction project that is not cost-effective as a stand-alone project could become cost-effective if other funding sources pay for related project costs (for example, resurfacing the street). If such opportunities require a significant scheduling change, the I/I project's cost-effectiveness would need to be re-evaluated.

The County and local agencies are continuing to evaluate and discuss both policy and legal issues related to funding. A preliminary legal analysis suggests that all funding options, including publicly funding I/I repairs on private property are feasible. Results of a telephone survey conducted late 2004 with homeowners in the service area indicate that homeowners are split almost in half on a number of issues, including who should pay for sewer repairs on private property, who should pay for land repairs resulting from sewer work on private property, and whether fixing I/I problems should be mandatory.

1.3.4 Defining Roles and Responsibilities

Consideration of County and local agency interactions and formal relationships will be an integral part of the I/I control program. Discussions will continue about the nature and extent of inter-governmental agreements (IGAs) or service contract amendments related to implementation of an I/I control program and specific I/I projects.

[3] See "Basis for Program Alternatives" below for a discussion of standards, procedures, guidelines, and policies.

Pilot project results indicate that property owner participation increases with knowledge about I/I and its impacts on the costs of wastewater conveyance, treatment, and disposal. The County and local agencies generally agree that a public education and involvement program is a necessary and beneficial part of the I/I control program. The roles of the County and local agencies in such a program are still open. Several options are being considered. The County could act as the lead on all regional efforts, while local agencies could be responsible for public education efforts in their service areas. Or the County and local agencies could work cooperatively to develop and implement both regional and service-area-specific education and involvement programs. Or local agencies could take complete responsibility for all public education and involvement efforts.

The County and local agencies are considering the establishment of centralized program management that would organize and manage follow-through for agreed-upon action items and coordination and communication during program implementation. Program management would also encompass planning, analysis, and integration of I/I control measures and conveyance needs.

1.4 Basis for Program Alternatives

1.4.1 Flow Monitoring and Pilot Projects

Flow monitoring was conducted during the winter of 2001–2002 to identify sources and volumes of I/I in drainage basins throughout the separated sewer system.[4] On the basis of the flow monitoring data and a set of agreed-upon criteria, local agencies selected ten I/I pilot projects. The purposes of the projects were to determine if sources of I/I could be located and repaired and to gain a better understanding of the issues associated with implementing I/I reduction projects. Work on each pilot project consisted of identifying I/I sources through field investigations, designing and constructing rehabilitation improvements, and monitoring post-construction flows to determine the effectiveness of the rehabilitation. The projects were completed early in 2004.

The most important lesson learned from the pilot projects is that through monitoring, field investigation, and rehabilitation of sewer collection systems, it is possible to successfully identify, target, and reduce I/I—in large part because of strong collaboration between King County and local agencies at every step of the process. Rehabilitation technologies reduced I/I in eight of the ten pilot projects. The highest reductions occurred in projects that included rehabilitation of sewers on private property, indicating that significant reductions can be achieved where I/I originates on private property. Results also indicate that measurable reductions can be expected to occur only in areas with higher levels of I/I and only by focusing repairs on appropriate system components.

1.4.2 Draft Standards, Procedures, Guidelines, and Policies

RWSP policies require that the County, in coordination with component agencies, develop model conveyance system design standards, including inspection and enforcement standards, for use by

[4] Flow monitoring was also conducted in 2000-2001, but there was not enough rainfall to yield sufficient data.

local agencies to reduce I/I in their systems. In 2002, the County and local agencies drafted standards, procedures, guidelines, and policies and then applied them to the pilot projects to test how well they worked. In 2004, the County and the E&P Subcommittee revised the standards, procedures, guidelines, and policies to reflect lessons learned from the pilot projects.

The draft standards, procedures, guidelines, and policies address a wide range of topics, including connections to side sewers, pipeline and manhole leak inspections, system maintenance, and construction practices and materials for I/I control projects. They are intended (1) to guide the engineering and construction of future sewer system infrastructure (new and rehabilitated) to achieve long-term I/I control, and (2) to limit system degradation and I/I increases over time. The County and local agencies will continue to refine the standards, procedures, guidelines, and policies during implementation of the long-term I/I program.

1.4.3 Planning Assumptions

RWSP policies call for integration of I/I study results with planning for wastewater conveyance facilities. Since adoption of the RWSP, conveyance planning is now being conducted on a geographic basis by natural drainage basins. This approach allows for more detailed assessment of population growth, conveyance needs, and I/I control in each basin.

In spring 2004, the County and the E&P Subcommittee defined specific regional I/I control program planning assumptions. The planning assumptions include factors such as design flow criteria, population growth rates, water conservation, system degradation, septic conversion rates, new system I/I allowance, and unit costs and reduction effectiveness of different rehabilitation technologies.

The planning assumptions were used, in part, to project future I/I flow volumes, capacity demands, and I/I reduction rates for different repair techniques. Recently, the County used this information to complete a Regional Needs Assessment of its conveyance system. The assessment estimates through 2050 when conveyance facilities will need to be online to accommodate the 20-year peak flow.[5]

The Regional Needs Assessment and the regional I/I control program will form the framework for updating and modifying recommended conveyance system improvements. The I/I reduction rates in the planning assumptions will be applied to a the model to identify potential cost-effective I/I control projects that could reduce or eliminate the need for particular conveyance system capital projects. The model results, in addition to information in this alternatives/options report, will be used to develop a regional I/I control program.

1.4.4 Criteria for Benefit-Cost Analysis

Cost-effectiveness of I/I reduction will be determined through application of a benefit-to-cost ratio that compares the cost of I/I repair and rehabilitation projects to the cost of conveyance

[5] The 20-year peak flow design standard was mandated in RWSP policies and confirmed during development of the planning assumptions.

system improvement and treatment plant capacity projects. I/I reduction projects will be considered cost-effective if they meet two criteria, either on a regional or a project-specific basis:

- The I/I project must reduce, delay, or eliminate planned conveyance system improvements.
- King County's cost for the I/I reduction project must be less than the combined cost of treating I/I flows and the cost of the planned conveyance system improvement.

1.5 Next Steps

King County staff and the E&P Subcommittee will hold regular biweekly meetings, as needed, to discuss the topics discussed above and to move toward consensus on a preferred program alternative and its various program components. Meetings will take place from March through September 2005, when a final program recommendation will be developed.

The County is currently conducting a benefit-cost analysis, scheduled to be complete in the second quarter of 2005. From this analysis, a list of cost-effective I/I projects will be identified and their timing and locations will be determined. Once the list of cost-effective I/I projects and their associated cost savings from the existing Conveyance System Improvements budget are known, the County and local agencies can make informed decisions as they narrow in on a preferred program alternative.

By June 2005, a list of "least-cost" projects required to meet the RWSP's 30-percent regional I/I reduction goal will be prepared and presented to the E&P Subcommittee. The list will be derived from the same information and assumptions used for the cost-effectiveness analysis. The list of projects and associated costs necessary to reach a 30-percent reduction goal will inform decisions about the cost-effectiveness of achieving this I/I reduction goal.

By December 31, 2005, the King County Executive will submit to the King County Council a plan for a long-term Regional Inflow and Infiltration Control Program. The I/I program will be reviewed every other RWSP update cycle, or every 6 years.